OUR ASTRONOMICAL COLUMN.

THE GREENWICH SECTION OF THE ASTROGRAPHIC CATALOGUE.—At the meeting of the Royal Astronomical Society held on March 11, the Astronomer Royal gave the chief particulars concerning the first part of the Greenwich section of the International Astrographic Catalogue, which is now quite ready for publication. The whole section comprises the region between declination +64° and +90°, whilst the part soon to be published deals with the region +64° to +72° inclusive, and covers 1077 square degrees, containing 80,000 stars. From the results already obtained it is computed that the complete Greenwich contribution to the catalogue will include about 179,000 stars.

In his communication Mr. Christie stated that the number of stars per square degree increases with the declination until a maximum is reached at +76°; this effect is probably due to the Milky Way. A discussion of the relative magnitudes of the stars obtained on the catalogue plates has shown that stars down to at least the eleventh magnitude appear on negatives which received six minutes' exposure (the *Observatory*, April).

THE COMPUTATION OF ELEMENTS FOR AN ANNULAR ECLIPSE.—A paper by Herr Zwack, secretary of the Philippine Weather Bureau, issued as a supplement to the *Bulletin* for August, 1903, explains the method used in computing the elements for an annular eclipse of the sun. The method of successive approximations is illustrated by a detailed explanation of the procedure employed in computing the elements for the annular eclipse of March 17, 1904, as seen at San Domingo (Batanes Islands) and Manila (Luzon).

RAPID CHANGES IN A SUN-SPOT.—In a communication to No. 343 of the *Observatory*, Mr. Denning gives particulars of some rapid changes which he saw take place in a sun-spot on January 22. The spot was one of four in the north-west quadrant, and it had a triple umbra. Whilst Mr. Denning was observing, one of these umbræ became greatly modified, and two new small spots appeared. Mr. Denning suggests that much valuable information regarding the behaviour, the formation, and the cyclonic conditions of spots might yet be obtained by more persistent observations. Solar observations generally terminate when the positions and forms of the spots have been recorded, and from these records valuable knowledge as to the period and loci of sun-spots has been deduced, but for about the last forty years very little consistent work has been done in *persistently* noting the minute yet constant changes which take place in the disturbed regions about spots.

Mr. Denning further suggests that daily observations extending over several hours would probably produce results which would completely justify the outlay of the time necessary for making them.

PHOTOGRAPHIC OBSERVATIONS OF BORRELLY'S COMET (1903 *c*).—A paper by Mr. Sebastian Albrecht in No. 2, vol. xix., of the *Astrophysical Journal* describes thirty-one negatives of the comet 1903 *c*, taken at the Lick Observatory, between June 22 and August 18 inclusive, with the Crocker telescope and the Pierson camera respectively.

The negatives show two tails, one about 10° in length and generally straight, the other about 1°·5 in length and much curved. In addition to these, occasional streamers developed and were generally fairly persistent, narrow and straight, sometimes emanating from the main tail, sometimes from the coma. The modifications in the main tail which have been previously noted by the observers at the Nanterre and Yerkes Observatories are very prominently shown on the negatives secured at Lick on July 23, 24 and 26, three beautiful reproductions of which accompany Mr. Albrecht's communication. The negative of July 23 shows an entirely new tail, having a length of about 4° and an angular width of about 4°·6, issuing from the head and preceding the radius vector by about 6°. This feature is not shown on the negative secured on July 24.

The paper also contains a discussion of the various changes, together with several tables giving the dimensions and positions of the tails and streamers which are shown on the negatives.

THE EVOLUTION OF EMPIRE.

NO matter what may be the subject of investigation, the process of evolution always appears as a progressive movement from the simple to the complex, from homogeneity to heterogeneity. It is so in zoology when the simple self-contained cell by segmentation sets out on the upward path of organisation; it is so in sociology when the primitive homogeneous community through division of labour takes the first step in civilisation; it is so in art; it is so in letters; it is so in all the multifarious domains of human experience, and the evolution of empire forms no exception to the rule. In every case the method is the same. The course pursued is a zig-zag or spiral, which tends now towards difference and again towards agreement; there is a constant ringing of the changes between variation and integration, and the goal is ultimately reached under the simultaneous or alternate influence of the forces of separation and union.

In the cooperation of these apparently antagonistic factors towards a common end lies the paradox of all ages. It is the riddle of the sphinx which each succeeding generation must solve or succumb. Ancient philosophy made many good guesses at the truth. Herakleitos, 500 B.C., wrote, "Opposition unites; from what draws apart results the most beautiful harmony; all things take place by strife." Empedokles a few years later spoke of creation as the product of love and strife, "From these come all things that are or have been or shall be." Still later Plato, referring to the teaching of Empedokles, wrote, "Being is many and one and is controlled by hate and love; borne apart it is always borne together." The Persians personified the antithesis under the dualism of Ormuzd and Ahriman, the powers of light and darkness. So universal is this concerted antagonism that it seems to be inherent in the very essence of things, and is doubtless a manifestation of the polarity which pervades creation. Even in music, the most fugitive and intangible of arts, the process of evolution through difference and agreement is clearly marked. The simplest music is in unison—to this succeeds a differentiation into various parts, and these are ultimately blended in harmony. So that the sequence, here as elsewhere, is from unity, through difference, up to union, the reintegration being more complex and in a far higher plane of performance than the uniformity from which it was evolved.

It was left for Darwin to focus the vague surmises of his predecessors and to demonstrate the systematic operation of variation and integration in the production of new forms. Science since his day has been occupied in applying his theory to fresh fields of inquiry, and in no department has a richer harvest of results rewarded the investigator than in tracing the application of the laws of evolution in the development of communities.

Comte was of opinion that the most fruitful results would follow the process of sociological suggestion followed by zoological verification, and striking confirmation of the efficacy of this method is found in the fact that Darwin got the first hint of his discoveries from contemplating the dilemma of Malthus with regard to population. This sequence is most rational, for selection has arrived at a far greater degree of finality and excellence in living forms than in social organisms. In each case nature proceeds by continual invention and experiment and ruthless discarding of failures, but in zoology the problems are simpler, because the factors are more determinate than in sociology. The rigorous dynamics of blood pressure and the limitation of speed of nerve currents are fixed conditions which prescribe the economic size of the individual. These conditions have existed since the beginning of the world—the necessity of rapid reaction to stimulus and of vascular efficiency has caused the elimination of the unwieldy antediluvian monsters in favour of the marvellously agile and tensely arterialised modern carnivora.

In sociological problems the hand of nature is still that of the apprentice. New conditions as to communication and transport have rendered previous conclusions nugatory. The difference in speed of communication to-day as compared with 300 years ago is illustrated by the fact that the news of Queen Elizabeth's death did not reach some parts

© 1904 Nature Publishing Group

of Devonshire until the Court was out of mourning, whereas the message announcing the death of Queen Victoria outstripped the sun. It has been well said that the extent of the unit of government is determined by the facility of communication, so that in the age of electricity all former notions in this respect have to be recast.

Nature may therefore be said to be still in the first chapter of Genesis in regard to social evolution. Probably with abundant provision for autonomy the social organism may eventually be found to be capable of world-wide extension, and the poet's dream of the parliament of man and the federation of the world may at some remote epoch be realised. But this far off event will not be hastened, but rather retarded, by any premature attempt to snatch attainment. A pebble dropped into a pond stirs in ever widening waves the whole surface of the water, but the extension depends on the orderly progression of each succeeding circle. There are no sudden leaps in evolution. "From lower to the higher next, not to the top is Nature's text." It is by timely limitation that the due furtherance of the process is ensured.

The evolution of empire is of intense interest to all, and is of vital importance to the British race, because it has stretched further afield and covers a greater and more diverse area than has ever been previously attempted. The idea which possessed many well disposed people at the advent of the International Exhibition epoch that the future rivalry of nations would take place in a fair field of industrial emulation, that fiscal barriers would be abolished, and that war would soon become an anachronism, must now, to say the least, be pronounced as premature. It is true that the nation, which was formerly regarded as the finished social product, has become the raw material out of which empires are constructed. The areas of government have consequently been extended, but it is only what may be regarded as division fences that have been removed. The ring fences are higher than ever. The international nexus is still of the feeblest texture, and organisation must for a long period continue to be intra- and not inter-imperial. Those are the best cosmopolitans, and best advance the destined solidarity, who pay due regard to the definite problems of the present. It is quite certain that the future will be attained by a continuance of the recognised methods of natural selection, namely, cooperation within the circle and competition without. It is well constantly to bear in mind the invariable biological rule that organisation must increase with size. Mere bulk without adequate organisation only serves to increase vulnerability. The view that the British Empire, the most extensive of all, can afford to remain less organised than any is a dangerous heresy. Not further aggregation but integration is the pressing need of the age, and the success which has in recent years attended the bringing of large areas under the federal form of government indicates that in federation will be found the best means of uniting the widely extended territories of Greater Britain. This indication is also supported by theoretical considerations, for federation affords the fullest scope for the variation and the adaptation to local conditions so indispensable to progress; while at the same time it provides sufficient integrating power to coordinate the diversified elements for defence and mutual advancement. It combines firmness with flexibility, and reconciles empire and liberty.

In the middle of last century the government of the colonies from Downing Street was found to be impracticable, and such centralisation would be doubly impossible now that both area and diversity have so greatly increased. To the preceding generation of statesmen the only alternative to the old colonial system appeared to be separation, and most assiduously they set to work to loosen the bonds and to facilitate the severance of the colonies from the Mother Country, and it was in order to pave the way to this desired dissolution that autonomy was granted. In adopting this course they were, however, all unconsciously ministering to the evolutionary requirements of a combined and not of a disintegrated empire. For at that stage the prime necessity for higher organisation was to provide free play for the variation which the diverse circumstances of the widely scattered colonies demanded. The result has been the unfettered development of nations such as Canada and Australia, which have attained an individuality of their own without any diminution, but rather with an increase, of attachment to the Mother Country. They are still daughters in their mother's house, though mistress of their own.

The requirement to-day is for sufficient integrating force to bring the diversified elements into organic union, so as to present a united front to the world and compete on equal terms with highly organised rivals. The harmonious evolution of the empire will then appear as an orderly sequence from the unity of the old colonial system, through the diversity engendered by the "beneficent neglect" and apathy of fifty years ago up to the coordination of individual but component nations in imperial federation. From the scientific standpoint the subject is fascinating, but the question that presents itself to the practical British mind is whether it is possible from a study of the mode of operation of the laws of evolution not only to comprehend the past, but to derive guidance for the future.

The withdrawal of British troops from the colonies, although at the time the step was greatly regretted, enabled the local defences, by a partial elimination of red tape, to be organised on lines better adapted to actual requirements; and we have seen with what advantage the different contingents cooperated on the veldt. Imperial countenance instead of discouragement to the development of similar individuality in naval affairs might be expected to yield equally good results. Many statesmen, both at home and in the colonies, have expressed the opinion that a mistake was made in granting fiscal autonomy to the colonies. This is probably an erroneous view; uniformity would have hindered the requisite variation. But that is no reason why, under an integrating influence, some form of coordination of tariffs might not now with advantage be effected.

In a federation many matters which are ordinarily under central control devolve upon the component States and municipalities, and thereby congestion of the central Government is avoided and autonomy is fostered. Thus the integrating influence in no way checks the working out of their own problems by the people on the spot who have the most intimate knowledge of local requirements. The time is far distant yet when a federal legislature can be established, but the sooner a permanent council of advice is erected the better for the avoidance of blunders in colonial administration. The integrating process must in no way be permitted to stunt colonial individuality and initiative; these should be treasured as the qualities which have led to the pre-eminence of the race. The refusal to crystallise into system is the characteristic of the Anglo-Saxon as compared with the Latin races, and from this capacity for variation springs the genius of the British race for successful colonisation and world-wide empire building.

John A. Cockburn.

A BOTANICAL LABORATORY IN THE DESERT.[1]

The great impetus given to physiological and œcological botany by the foundation of research laboratories within the tropics gives some indication of the latent possibilities of the new laboratory established in the desert, where the botanical problems awaiting solution are many and varied. While numerous observations have been made upon the morphology of desert-plants, only a few detached physiological experiments have been conducted on them; yet the desert, with its sharply marked and exaggerated characters, offers a favourable field for research into manifold phases of physiological activity, and such research cannot fail to bring to light truths having a general application to plants of all climes.

Again, inquiries into the details of the geographical distribution should yield much valuable information. Of the flora of a desert tract it is known that many constituent species are descendants of outcasts from the adjoining more fertile lands, but that others belong to a few widespread orders or genera which reappear in deserts far apart, and thus show their antiquity of possession, and finally that

---

[1] "Desert Botanical Laboratory of the Carnegie Institution." By F. V. Coville and D. T. MacDougal. (Washington, U.S.A.: Published by the Carnegie Institution, 1903.)

© 1904 Nature Publishing Group